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A superficial study of the pine-barren vegetation of Mississippi

ROLAND M. HARPER

(WITH THREE TEXT-FIGURES)

In Mississippi *Pinus palustris* is confined to the southern half of the state, and the region in which it is the dominant tree, constituting the pine-barrens, covers about 13,000 square miles, or less than one third of the state. The pine-barrens proper (in Mississippi but not in any of the states farther east) are confined to the area underlaid by a non-calcareous formation supposed to be of late Tertiary age, which has been called Grand Gulf in Mississippi and Alabama and Altamaha Grit in Georgia. The boundary between this and the limestone region which borders it on the north seems much less distinct in Mississippi than in Georgia,* but is approximately 100 miles from the coast. In western Mississippi this formation is overlaid by a brownish silty loam of supposed aeolian origin, known as the loess, which is many feet thick along the Mississippi River but thins out gradually eastward and disappears entirely in the neighborhood of the Pearl River. Where the loess forms the surface the long-leaf pine is absent and other pines scarce, and the forests are mainly of the ordinary southern hardwood type, much as in the northern parts of the state.

Previous literature.—The following list is believed to contain all the more important papers bearing on the phytogeography of the Mississippi pine-barrens, except a few for the whole state which were cited in my paper on northern Mississippi last year,† and a few primarily geological ones. The arrangement is chronological.

(Mrs.) **Martha B. Flint.** Notes from the Mississippi pine barrens.

Bot. Gaz. 7: 43. Apr. 1882.

— The exogenous flora of Lincoln Co., Mississippi, from October to May. Bot. Gaz. 7: 74-76, 79-81. June and July 1882.

* See Bull. Torrey Club 32: 144. 1905.

† Bull. Torrey Club 40: 377-399. pl. 21, 22. Au 1913.

- B. D. Halsted.** Southern Mississippi floral notes. Gard. and For. **4**: 250-251. 27 May 1891.
Relates to the vicinity of Ocean Springs, in May.
- The giant sundew heliotropic. Bull. Torrey Club **18**: 212-213. July 1891.
Relates to the plant now known as *Drosera filiformis Tracyi* (Macfarlane) Diels,* and a few other species observed around Ocean Springs.
- Charles Mohr.** The timber pines of the southern United States. U. S. Forestry Bull. **13**. 1896 and 1897.
Notes on long-leaf pine in Mississippi on pages 42-43.
- C. L. Pollard.** Studies in the flora of the central Gulf region. Bull. Torrey Club **24**: 148-158. Mar. 1897.
- Andrew Allison.** Notes on the winter birds of Hancock County, Mississippi. The Auk **23**: 44-47. Jan. 1906.
Contains about a page of interesting notes on the vegetation.
- R. M. Harper.** Midwinter observations in southeastern Mississippi and eastern Louisiana. Torreya **6**: 197-205. f. 1. Oct. 1906.
- J. S. Holmes & J. H. Foster.** Condition of cut-over long-leaf pine lands in Mississippi. U. S. Forest Service Circular 149. 8 pp. May 1908.
- A study of forest conditions of southwestern Mississippi. Miss. Geol. Surv. Bull. **5**. 56 pp. and folded colored map. Dated January, 1908, on title-page and March 17, 1909, in letter of transmittal, but not distributed until 1910 or 1911.
- E. N. Lowe.** A preliminary study of the soils of Mississippi. Miss. Geol. Surv. Bull. **8**. 220 pp., outline map, and 23 half-tones, mostly in text. 1911.
Contains copious notes on vegetation.
- W. N. Logan.** The soils of Mississippi. Miss. Exp. Sta., Technical Bull. **4**. 49 pp. and folded colored map. 1913.
- R. M. Harper.** The forest regions of Mississippi in relation to the lumber industry: a geographical and statistical study. Southern Lumberman **70**⁹³⁵: 27-28. 23 Aug. 1913.
Includes a small geographical map. Also reprinted in octavo size, with 8 pages.
- E. N. Lowe.** Note on the flora of Mississippi. Miss. Geol. Surv. Bull. **11**: 137-166, including full-page geographical map. Dec. 1913.
This paper divides the state into nine divisions, and sketches the vegetation of each. It has also been issued separately as a 32-page pamphlet with the title "A brief note on the floral regions of Mississippi." The remainder of Bulletin 11 consists of Bulletins 5 and 7 reprinted, with the addition of three half-tone plates copied from other publications, and a 3-page statistical supplement on the lumber industry of Mississippi.

* Described in Engler's Pflanzenreich **4**¹¹²: 92. 1906.

The government soil surveys of Lincoln, Wayne and Forrest Counties and the McNeill, Biloxi and Scranton areas, published in recent years, are valuable in this connection, but not as much so as if their authors had been more familiar with previous literature and the local geography, geology and flora, and if chemical analyses of soils had been included.

Itinerary.—In December, 1905, I spent a day in the pine-barren region of Mississippi near Hattiesburg, and the next day observed the vegetation from the train between Lumberton and the Pearl River *en route* to New Orleans. A few days later, in January, 1906, I traveled the whole length of the Mississippi coast by rail, with a brief stop at Gulfport. On October 18, 1908, traveling northward on the Mobile & Ohio R. R., I entered the state at State Line, in the northeastern corner of Greene County, and left the pine-barrens near Waynesboro, about 20 miles farther on. On July 20, 1911, I walked into Mississippi a few miles northeast of Buckatunna,* in Wayne County, and traveled on the Mobile & Ohio R.R. from Buckatunna to State Line and beyond. In July, 1913, I entered the region under consideration from the west somewhere near Brookhaven, on the Mississippi Central R.R., and traveled through it for about 300 miles, via Wanilla, Foxworth, Columbia, Maxie, Gulfport, Pascagoula (formerly Scranton), Evanston, Beaumont, and Laurel.† On this trip notes were taken from the train nearly every mile, and also on the ground for a few minutes or hours in the vicinity of Columbia, Biloxi,‡ Fontainebleau, Pascagoula, and Moss Point.

PHYSICAL FEATURES

Soils.—The soil of the pine-barren region is in the main a sandy loam, the proportion of clay increasing with the depth. On the uplands the soil is usually grayish and the subsoil brick-red, and in some places the red clay comes nearly or quite to the surface. There is at present some difference of opinion among geologists as to whether the surface sand and clay of this and

* Misspelled "Bucatunna" by the U. S. Post Office Department.

† All the places mentioned in this sentence are railroad junctions, but some of them are so new that they can be located only on the most modern maps.

‡ At (or rather near) Biloxi I enjoyed the hospitality of Professor S. M. Tracy, as many other botanists had done in previous years.

other pine-barren regions represent distinct formations of late Tertiary or Quaternary age (Columbia and Lafayette), or are merely products of weathering from the underlying marine Tertiary formations.*

Deep beds of sand, such as are common on the left sides of creeks and rivers in the corresponding parts of Georgia, are rare in Mississippi, and the Mississippi pine-barren soils seem to average a little richer than those farther east. But in comparison with soils farther inland these are poor in available mineral plant food, especially near the coast, where the diminished seasonal fluctuation of the ground-water seems to limit the supply of available potash, etc., in a manner not yet fully understood, but perhaps simply by preventing aeration. The richest soils in this region are along streams which pass through calcareous regions farther inland, and west of the Pearl River where the influence of the loess is felt.

The following partial analyses extracted from Dr. Hilgard's report on Mississippi in the 5th volume of the Tenth Census will serve as a basis for comparing these soils with those of northern Mississippi and other nearby or similar regions. They are from three localities, a pine ridge in Simpson County, the hammock or second bottom of the Pearl River in Marion County, and the "pine meadows" of Jackson County. In the first two cases both soil and subsoil were analyzed. The percentages of only lime (CaO), potash (K₂O), "phosphoric acid" (P₂O₅), and magnesia (MgO) are given here.

All of these, especially the last, are considerably below the

* Advocates of the latter hypothesis claim that the process of weathering tends to wash out the clay and concentrate the sand on the surface. If this were universally true then the oldest soils would be the sandiest; but in the interior hardwood region (e. g., in Middle Tennessee, Kentucky, etc.), where the soils are residual from Paleozoic rocks, and have been exposed to weathering processes many times longer than the region under consideration, clay predominates on the surface, and sand is chiefly confined to the beds of streams. Even on the Cumberland Plateau, where the rocks are mostly sandstone, the soils are decidedly loamy. To explain this difference between the soils of Tennessee and southern Mississippi it will probably be necessary to take into consideration the seasonal distribution of rainfall. In Middle Tennessee and a great deal of neighboring territory the summers are pretty dry, while in the region under consideration, as in most other parts of the coastal plain, summer is the rainy season; which must make a considerable difference in the processes of weathering.

	Lime	Potash	Phos. Acid	Magnesia
Simpson County ridge061	.074	.069	.112
Subsoil of same.....	.038	.169	.041	.229
Pearl River hammock.....	.113	.124	.169	.141
Subsoil of same.....	.054	.169	.059	.212
Jackson County pine meadow.....	.023	.061	.021	.069

average in fertility, which explains why this and other pine-barren regions still retain so much of their native vegetation. The density of population and amount of woodland remaining are pretty closely correlated with the soil characters. In 1910 the portions of the pine-barren region west of the Pearl River had about 40 inhabitants to the square mile (which is pretty close to the state average), the three coast counties about 25, and the whole region about 30. The amount of woodland varies from 69 per cent. west of the Pearl River to 90 per cent. east of there, while for the whole state it is 64 per cent.

But notwithstanding the poverty of pine-barren soils in mineral plant food, they are easily tilled at all seasons, and respond readily to applications of commercial fertilizers, and for the last few decades farmers have been taking possession of them very rapidly. From 1900 to 1910 the population of the region under consideration increased 45 per cent. (over 50 per cent. east of the Pearl River, where the poorer soils are located), and similar developments were going on in the corresponding parts of other southeastern states at the same time, necessitating among other things the building of many new railroads and the creation of several new counties, and thus keeping map-makers busy.

Topography and hydrography.—The topography is very similar to that which I have already described for the corresponding parts of Georgia,* Florida,† and Alabama.‡ In the parts most remote from the coast it is moderately hilly, and some of the smallest valleys that contain permanent streams may be as much as 50 feet deep. Toward the coast, where erosional forces have been less active on account of the lesser elevation, the local relief is less, and ponds and swamps are more frequent. In some places, especially in Jackson County, the country is almost perfectly

* Bull. Torrey Club 32: 146. 1905; Ann. N. Y. Acad. Sci. 17: 24. 1906.

† Ann. Rep. Fla. Geol. Surv. 3: 218-219. 1911.

‡ Geol. Surv. Ala., Monog. 8: 114-115. 1913.

flat for miles, forming the "pine meadows" described by Hilgard* and others; but usually the country is a little undulating right down to the coast.

As in the pine-barrens of Georgia and Alabama, the streams that rise within the region carry little sediment and do not fluctuate much. The Pearl and Pascagoula Rivers drain parts of the Eocene red hills to the northward and are therefore somewhat muddy. In the lower and flatter parts of the region the groundwater is of course always near the surface (for it can hardly sink below sea-level), and the soil is therefore always damp. The most typical or characteristic pine-barren plants are found in such situations. The existence of a large paper mill at Moss Point, at the mouth of the Escatawpa River, one of the typical coffee-colored pine-barren streams, is probably correlated with the freedom of the water from mineral substances in suspension or solution.

Climate.—The following climatological data, extracted from the annual summary of the Mississippi section of the U. S. Weather Bureau for 1911, will give an idea of the salient features of the climate of this region. Eight stations have been selected, as follows: Waynesboro and Jackson, just north of the region, Brookhaven, about on its western edge, Natchez and Woodville, farther west, and Pearlinton, Bay St. Louis and Biloxi, on the coast. The data given here are mean temperature for January and July, average annual rainfall, and proportion of the total rainfall in the four warmest months, June to September, and the six warmest months, May to October. The first two columns of figures are degrees Fahrenheit, the third inches, and the last two percentages.

It may be observed at once that not only is the rainfall more copious toward the coast, but also a larger proportion of it comes in summer there, so that if absolute instead of relative figures for summer rainfall were given the contrast between the coast and the interior stations in this respect would be still greater. Less comprehensible, but perhaps more interesting, is the fact that

* Geol. and Agric. Miss. 368-371. 1860. See also McGee, 12th Ann. Rep. U. S. Geol. Surv. 1: 368, 475. 1892; Mohr, U. S. Forestry Bull. 13: 60, 81. 1896; Contr. U. S. Nat. Herb. 6: 123-124. 1901; Harper, Torreya 6: 204-205. 1906.

Stations	January Temperature	July Temperature	Annual Rainfall	Percentage in	
				4 Months	6 Months
Waynesboro.....	47.2	80.9	50.50	35.9	47.2
Jackson.....	47.3	81.3	50.57	30.7	42.4
Brookhaven.....	48.0	81.6	58.42	33.3	44.4
Natchez.....	49.8	81.8	54.59	31.9	43.2
Woodville.....	50.1	81.4	59.55	35.3	47.4
Pearlington.....	52.0	80.9	57.92	41.8	52.4
Bay St. Louis.....	50.8	81.4	59.82	41.5	51.9
Biloxi.....	51.5	81.9	60.75	42.9	53.8

the summers are relatively drier west of the Pearl River, where the soils are richer, than in the more typical pine-barrens to the eastward. It is easy to imagine how the seasonal distribution of rainfall might affect the soils somewhat, as suggested on a preceding page, but in this case the loess near the Mississippi River must owe its location and character to geological causes rather than to any local climatic factors; and it may be that the soil itself, perhaps through the vegetation, influences the rainfall reciprocally to some extent.*

VEGETATION

From the notes taken in the five different years above mentioned a rough quantitative analysis of the vegetation has been derived.† The 1913 trip has furnished more data than all the others combined, partly because of its greater duration (over four days), and partly because it was made at a season when the number of flowers in the pine-barrens is near its maximum.

* See Bull. Torrey Club 37: 415-416. 1910; Torrey 12: 140-141. 1912; Geol. Surv. Ala. Monog. 8: 19, 24. 1913.

† One of the objects of this paper is to show how a botanical reconnaissance survey of an essentially homogeneous area of 13,000 square miles can be made in less than a week. At this rate a person sufficiently familiar with the flora could cover an area the size of New England, New York or Michigan in about a month, or the whole United States in five years, even if the country were made up of two or three hundred quite dissimilar areas of the size of the one here treated. Or five interested persons could cover the country in one year, or twenty persons (if so many phytogeographers could be found) in one summer. Even such hasty work brings out some fundamental and significant facts not previously known, and if more time can be devoted to it the results of course are still more satisfactory. (In view of these possibilities it looks like misdirected energy to spend months or years, as many botanists have done, in trying to make a complete collection of the plants of a single county or other restricted area, and publishing a list of them, which usually establishes no general principles and is therefore of very little scientific value.)

The list of plants given below is of course far from complete, for there must be nearly a thousand species of flowering plants in the area examined. But it probably contains most of the trees and shrubs that could be found, and most of the larger herbs. In a quantitative analysis of vegetation bulk is more important



FIG. 1. Looking east across Bayou St. Martin, near southwest corner of Jackson County. Pine-barrens on both sides (*Pinus Elliottii* at edge, *P. palustris* on higher ground), passing abruptly, with no intervening fringe of shrubs or hardwoods, into brackish marsh vegetation consisting mostly of *Juncus Roemerianus*. (The absence of a strip of hammock vegetation at the edge of the marsh probably indicates that the fires which keep the pine forest clear of underbrush sweep right across the bayou through the rushes.) July 16, 1913.

than number of species or individuals, and the herbs too small to recognize from a moving train, however interesting they may be to systematists, probably constitute less than 1 per cent. of the total volume of vegetation. The difficulty of recognizing some plants from a train has been partly counterbalanced, however, by the fact that I spent several hours on the ground near the coast, where typical pine-barren plants are most abundant.

To indicate as nearly as possible relative abundance, which is not necessarily the same as frequency, wherever a species was noted as abundant I have counted it three times in tabulating the returns, where common it is counted twice, and where rare it is not counted at all. (Even this does not do justice to the abundance of the

conifers, and if the figures for them were multiplied by two or three it would probably make the proportions more nearly correct.) Species seen less than four times are omitted entirely from the list. Trees, shrubs and herbs are separated, and evergreens are indicated by bold-face type, as usual. The names of plants are followed by a few words on habitat, which may be of interest to some readers.

TREES

283	Pinus palustris	Mostly on uplands, abundant throughout
152	<i>Nyssa biflora</i>	Small swamps, etc.
140	Pinus Elliottii	Small swamps and shallow ponds
126	Magnolia glauca	Non-alluvial swamps
122	Pinus Taeda	Low grounds, in richer soils
72	<i>Quercus marylandica</i>	Dry loamy uplands
64	<i>Liquidambar Styraciflua</i>	Richer soils mostly
46	<i>Cornus florida</i>	Loamy uplands mostly
40	<i>Taxodium imbricarium</i>	Small swamps and ponds, coastward
37	<i>Liriodendron Tulipifera</i>	Low grounds
36	<i>Quercus falcata</i>	Dry loamy uplands
31	Pinus glabra	Hammocks, etc.
25	Magnolia grandiflora	Hammocks, etc.
23	<i>Quercus Catesbaei</i>	Dry sandy soils
23	Pinus echinata	Dry loamy uplands
22	<i>Fagus grandifolia</i>	Hammocks, etc.
22	<i>Quercus cinerea</i>	Sandy uplands
21	<i>Acer rubrum</i>	Non-alluvial swamps
20	<i>Salix nigra</i>	River-banks and low grounds
18	<i>Taxodium distichum</i>	Swamps of larger streams
11	Quercus nigra	Creek-bottoms mostly
10	<i>Hicoria alba?</i>	Loamy uplands
9	<i>Nyssa sylvatica</i>	Loamy uplands
9	Ilex opaca	Hammocks, etc.
8	<i>Nyssa uniflora</i>	Along larger streams
8	<i>Oxydendrum arboreum</i>	Hammocks, etc.
8	Quercus geminata	Sand near coast
7	Quercus laurifolia	Hammocks, etc.
6	<i>Quercus Phellos</i>	Bottom lands
6	<i>Carpinus caroliniana</i>	Bottoms, etc.
5	<i>Quercus stellata</i>	Loamy uplands
5	<i>Diospyros virginiana</i>	Various situations
5	Quercus virginiana	Near coast
5	<i>Magnolia macrophylla</i>	Richer soils
5	Chamaecyparis thyoides	Sour swamps
4	<i>Quercus Michauxii</i>	Bottoms

SHRUBS AND WOODY VINES

68	Ilex glabra	Moist pine-barrens
42	Serenca serrulata	Low pine-barrens, coastward

32	Cyrilla racemiflora	Branch-swamps, etc.
29	Smilax laurifolia	Non-alluvial swamps
27	Myrica pumila	Low pine-barrens
24	Hypericum fasciculatum	Around ponds and branches
22	Rhus copallina	Uplands mostly
16	Rubus nigrobaccus?	A weed
13	Aralia spinosa	Hammocks
12	Myrica cerifera	Hammocks
11	Alnus rugosa	Branch-swamps, etc.
8	Rhus glabra	Near Pearl River
7	Cliftonia monophylla	Sourest non-alluvial swamps
7	Viburnum nudum	Non-alluvial swamps
6	Ilex myrtifolia	Shallow ponds near coast
6	Callicarpa americana	Hammocks, etc.
5	Bignonia crucigera	Bottoms mostly
4	Vitis aestivalis	Bottoms mostly
4	Sassafras variifolium	Mostly a weed
4	Diospyros virginiana	Various situations
4	Phoradendron flavescens	Mostly on <i>Nyssa biflora</i>

HERBS

93	Eriocaulon decangulare	Wet pine-barrens
50	Helenium tenuifolium	A weed, on roadsides, etc.
45	Rhexia Alifanus	Pine meadows, etc.
39	Eupatorium rotundifolium	Low pine-barrens
36	Sarracenia Sledgei	Wet pine-barrens
34	Sabbatia macrophylla	Wet pine-barrens
29	Lophiola aurea	Wet pine-barrens
26	Dichromena latifolia	Wet pine-barrens
26	Tillandsia usneoides	Mostly in swamps
26	Eupatorium capillifolium	A weed
26	Sabbatia campanulata	Low pine-barrens
26	Juncus Roemerianus	Brackish marshes along coast
23	Anastrophus compressus	A weed
23	Cracca virginiana	Dry pine-barrens
23	Polygala ramosa	Low pine-barrens
22	Campulosus aromaticus	Low pine-barrens
22	Eupatorium compositifolium	A weed, in dry soils
21	Tofieldia racemosa	Wet pine-barrens
20	Oxypolis filiformis	Wet pine-barrens, etc.
18	Cladium effusum	Fresh or slightly brackish marshes
17	Rynchospora Chapmani	Wet pine-barrens, coastward
16	Polygala cymosa	Cypress ponds mostly
16	Chondrophora nudata	Low pine-barrens
14	Stokesia laevis	Low pine-barrens
13	Anchistea virginica	Shallow cypress ponds, etc.
12	Eupatorium purpureum	Branch-swamps
11	Centella repanda	Low pine-barrens
9	Drosera filiformis Tracyi	Wet pine-barrens

9	<i>Osmunda cinnamomea</i>	Non-alluvial swamps, etc.
8	<i>Hibiscus aculeatus</i>	Low pine-barrens
7	<i>Sabbatia angularis</i>	Low pine-barrens
7	<i>Scleria Baldwinii</i>	Cypress ponds, etc.
7	<i>Panicum dichotomum?</i>	Low pine-barrens
7	<i>Xyris</i> sp.	Low pine-barrens
6	<i>Rhexia lutea</i>	Low pine-barrens
6	<i>Aristida stricta</i>	Dry pine-barrens mostly
6	<i>Chrysopsis graminifolia</i>	Dry pine-barrens mostly
6	<i>Sagittaria lancifolia</i>	Estuarine marshes
6	<i>Polygala cruciata</i>	Low pine-barrens
5	<i>Azelia cassioides</i>	Low pine-barrens
5	<i>Cyperus pseudovegetus</i>	Ditches, etc.
5	<i>Ludwigia pilosa</i>	Ponds and ditches
5	<i>Rhynchospora corniculata</i>	Shallow ponds, etc.
5	<i>Baldwinia uniflora</i>	Low pine-barrens
5	<i>Habenaria nivea</i>	Low pine-barrens
5	<i>Linum floridanum</i>	Low pine-barrens
5	<i>Spartina polystachya</i>	Brackish marshes
4	<i>Leptilon canadense</i>	A weed
4	<i>Sarracenia psittacina</i>	Low pine-barrens
4	<i>Rhynchospora semiplumosa</i>	Low pine-barrens
4	<i>Helianthus angustifolius</i>	Low pine-barrens
4	<i>Trilisa odoratissima</i>	Low pine-barrens
4	<i>Rhynchospora axillaris</i>	Low pine-barrens
4	<i>Saururus cernuus</i>	Swamps
4	<i>Carphephorus Pseudo-Liatris</i>	Low pine-barrens
4	<i>Lycopodium alopecuroides</i>	Low pine-barrens
4	<i>Rhynchospora Baldwinii</i>	Low pine-barrens
4	<i>Xyris flexuosa</i> *	Low pine-barrens

If we add together the figures for evergreens we find that 55.3 per cent. of the trees (six conifers and seven angiosperms) and 68.4 per cent. of the shrubs (counting *Cyrilla* as half evergreen) are evergreen. Of course a great deal of the most abundant tree, *Pinus palustris*, has been cut for lumber, much more proportionately than the cypress and hardwoods, which makes the percentage of evergreens lower than it would be for virgin forests. If a careful analysis of the forests of this region could have been made half a century ago the proportion of evergreens would probably have been found to be something like 75 per cent. This is in striking contrast with the northern half of the state, where the soils are more clayey and (therefore?) richer in potash, and where no natural region seems to have more than 20 per cent. of its trees evergreen.†

* *X. torta* of most nineteenth-century authors. See Torrey 5: 129. 1905.

† See Bull. Torrey Club 40: 395-396. 1913.

The Ericaceae and allied families are usually pretty well represented in pine-barrens and other sandy regions, and therefore it is rather surprising that only one member of this family, *Oxydendrum*, was seen more than three times in all the travels above outlined. This may be correlated with the fact that the soils in southern Mississippi are a little richer than those of the average pine-barrens; but on the other hand, the Leguminosae, which seem to prefer soils pretty well supplied with potash, etc. but poor in humus, as in areas frequently burned over, seem equally scarce here, only one species, *Cracca Virginiana*, being listed



FIG. 2. Flat damp pine-barrens, with trees mostly *Pinus palustris*, stunted and rather scattered, about half a mile north of Fontainebleau, Jackson County. July 17, 1913.

above. More extensive explorations are needed to solve the problem.

Comparisons with other pine-barren regions.—It will be instructive to compare the foregoing list of plants with quantitative lists previously published for the corresponding parts of Georgia* and Alabama.† In this way some conclusions can be drawn that would be utterly impossible with qualitative lists of the usual

* Plant World 15: 244. Oct. 1912.

† Geol. Surv. Ala. Monog. 8: 116-117. June 1913. (This includes trees only.)

type. It is quite evident that the following species are more abundant in Georgia:—*Taxodium imbricarium*, *Quercus Catesbaei*, *Pinus serotina*,* *Quercus cinerea*, *Cliftonia*, *Ilex myrtifolia*, *Nyssa Ogeche*,* *Serenoa*, *Quercus pumila*, *Aristida stricta*, *Eupatorium compositifolium*, *Sarracenia flava*,* *Chondrophora nudata*, *Eriogonum tomentosum*,* *Baptisia perfoliata*,* and *Kuhnistera*; and the following in Mississippi:—*Pinus Taeda*, *Liquidambar*, *Quercus marylandica*, *Cornus florida*, *Pinus glabra*, *Magnolia grandiflora*, *Fagus*,† *Pinus echinata*, *Taxodium distichum*, *Nyssa sylvatica*,† *N. uniflora*, *Oxydendrum*,† *Magnolia macrophylla*,† *Chamaecyparis*,† *Rhus copallina*, *R. glabra*,† *Sassafras*, *Sarracenia Sledgei*,† *Sabbatia macrophylla*, *Lophiola*, *Eupatorium capillifolium*, *Juncus Roemerianus*,† *Cladium*,† *Stokesia*, *Drosera filiformis Tracyi*, and *Carphephorus Pseudo-Liatris*. It is significant that practically all the species here enumerated for Georgia are typical pine-barren plants, while most of those noted as being more abundant in Mississippi are more characteristic of richer soils (and drier summers) farther inland. Several of the species common to Georgia and Mississippi, such as *Pinus Elliottii*, *Taxodium imbricarium*, *Pinus glabra*, *Quercus geminata*, *Chamaecyparis*, *Cliftonia*, *Lophiola*, *Drosera filiformis Tracyi*, and *Sarracenia psittacina*, are not known west of the Mississippi River, while several others grow in Louisiana but not in Texas. All this tends to confirm the suggestion made a few years ago‡ that the principal center for pine-barren plants is in Georgia, where they also extend farther inland than they do elsewhere.

Very few quantitative studies of forests for areas larger than single counties have been made as yet, but from a few that have been published by the writer for other pine-barren regions the following percentages of evergreens have been computed:

Pine-barrens of New Jersey (July) 74.3 per cent.§

Cape Fear pine-barrens, North Carolina (July) 60 per cent.||

* Not known in Mississippi at all.

† Not known in the Altamaha Grit region of Georgia, but all except *Sarracenia Sledgei* have been found elsewhere in South Georgia. *Juncus Roemerianus* and *Cladium* are chiefly confined to the neighborhood of the coast.

‡ Torrey *7*: 43. 1907.

§ Bull. Torrey Club *37*: 426. 1910.

|| Bull. Torrey Club *37*: 416. 1910.

Fall-line sand-hills of South Carolina (March) 59 per cent.; (July) 37.5 per cent.*

Pine-barrens of southern South Carolina (March) 72.4 per cent.; (July) 53.8 per cent.†

Flat pine-barrens of southeastern Georgia and northeastern Florida (March) 66 per cent.‡

Altamaha Grit region of Georgia (December) 56.9 per cent.§

Lime-sink region of Alabama (original forests) 75 per cent.; (present condition) 65 per cent.||

Southwestern pine hills of Alabama (original forests) 84 per cent.; (present condition) 72 per cent.¶

All these figures, except those for Alabama, are based almost entirely on car-window notes, like those for Mississippi, and are doubtless too low, for such notes do not do justice to the abundance of the conifers. The winter figures for evergreens are higher than the corresponding summer ones, on account of the difficulty of recognizing some of the deciduous trees in winter.

NOTEWORTHY SPECIES

The following notes on distribution are based on the trip of 1913, unless otherwise indicated.

Pinus Elliottii Engelm. The northwesternmost stations I have observed for this species, in different years, are as follows: (1) On the Mobile & Ohio R.R. between Winchester and Waynesboro, Wayne County; (2) on the New Orleans, Mobile & Chicago R.R. in the upper edge of Perry County; (3) on the Mississippi Central R.R. a little west of Hattiesburg; (4) on the Columbia branch of the Gulf & Ship Island R.R. in the lower edge of Lamar County a little west of Lumberton. These points may be taken as marking approximately the limits of its range in that direction.** Like most other typical pine-barren plants in Mississippi, it is not known west of the Pearl River, and is most abundant

* Bull. Torrey Club 37: 413. 1910; 38: 224. 1911.

† Bull. Torrey Club 37: 410. 1910; 38: 226. 1911.

‡ Bull. Torrey Club 38: 231. 1911.

§ Plant World 15: 244. 1912.

|| Geol. Surv. Ala. Monog. 8: 109-111. 1913.

¶ Ibid. 116-118.

** See Torreya 6: 200, 201, 203. 1906; Bull. Torrey Club 37: 603; 38: 236. 1911.

near the coast. *Pinus Taeda*, on the other hand, is common in the Pearl River bottoms, and rare coastward.

Pinus glabra Walt. is rather common near the Pearl and Leaf Rivers, and rare elsewhere in the pine-barren region. The same might be said of *Taxodium distichum*.



FIG. 3. Edge of cypress pond about a mile north of Fontainebleau, showing *Taxodium imbricarium* and *Pinus Elliottii*. July 17, 1913.

Taxodium imbricarium (Nutt.) Harper (*T. ascendens* Brong.). On the 1913 trip first seen about 15 miles north of Gulfport, and last near Merrill, George County,* about 50 miles inland. (On the Mobile & Ohio R.R. it does not seem to reach the point where the railroad crosses the Alabama-Mississippi line.) In the Carolinas and Georgia it extends about as far inland as *T. distichum* does, but the inland limits of the two species are far apart in Alabama and still more so in Mississippi and Louisiana.

Chamaecyparis thyoides (L.) BSP. Rather common in estuarine swamps of the Escatawpa River (not the Pascagoula, which is muddy) near Moss Point, and seen also in a branch-swamp near the middle of Jackson County.

Campulosus aromaticus (Walt.) Trin. Seen first in Forrest County, last in Jones County. Usually in damp pine-barrens with *Rhexia Alifanus*, as in the Carolinas.

* This county was created from parts of Greene and Jackson Counties in 1910.

Dichromena latifolia Baldw. First noticed in the lower edge of Forrest County and last in the upper part of Jackson County. Usually accompanied by *Lophiola aurea*.

Serenoa serrulata (Michx.) B. & H. In Mississippi this is rarely seen more than five miles from the coast.

Eriocaulon decangulare L. Seen first in the eastern part of Marion County and last in Jones County; extending farther inland than many of the more typical pine-barren plants.

Lophiola aurea Ker. First in the lower edge of Forrest County, last in the lower edge of George County.

Myrica inodora Bartr. Arborescent in a non-alluvial swamp near Moss Point, Jackson County.

Quercus pumila Walt. What I take to be this species was seen from the train three or four times in dry pine-barrens in Jackson County on July 18th. It does not seem to have been reported from Mississippi before, or even from Alabama; but Professor Tracy tells me that he has seen it somewhere west of Biloxi.

Quercus Catesbaei Walt. In Mississippi this seems to be commonest between 50 and 75 miles from the coast. I have seen it as far inland as Marion, Perry and Wayne Counties.

Sarracenia Sledgei Macfarlane. This species, which takes the place of *S. flava* in Mississippi, was seen in 1913 first in the lower part of Lamar County and last near Lucedale, George County; both localities being about 45 miles inland. Along the Mobile & Ohio R.R., however, it extends up into the southeastern corner of Wayne County, about 63 miles from Mobile.

Sarracenia rubra Walt. A few specimens were seen in low pine-barrens northeast of Buckatunna in 1911.

Magnolia macrophylla Michx. Occasional in rich soil near the Pearl and Leaf Rivers. More common in the loess region west of the pine-barrens, in Franklin County, as was noted by Hilgard in 1860.*

Crataegus aestivalis (Walt.) T. & G. In shallow ponds, where the red clay is near the surface, near Agricola, George County, July 18, 1913; and perhaps also near Buckatunna, Wayne County, October 18, 1908.

Polygala cymosa Walt. Seen first near Ten Mile, Harrison

* Geol. & Agric. Miss. 323-324. (§ 703).

County (about 27 miles inland), and last in the upper edge of Jackson County. Commonest within a mile or two of the coast. *P. ramosa* is more widely distributed, extending inland to Marion and Jones Counties.

Drosera filiformis Tracyi (Macfarlane) Diels. First about two miles north of Ocean Springs, Jackson County (not far from Professor Tracy's home), and last in the lower edge of George County.

Cliftonia monophylla (Lam.) Sarg. Extends inland to near Nugent, Harrison County, and Lucedale, George County. *Cyrilla racemiflora*, which sometimes associates with it, prefers richer soils and is less restricted in range.

Ilex myrtifolia Walt. In shallow ponds, Jackson County.

Ilex glabra (L.) Gray. Extends inland to Marion and Jones Counties, like *Eriocaulon decangulare*.

Rhexia Alifanus Walt. (*R. glabella* Michx.). Extends inland to the eastern part of Marion County and the southern part of Perry, but still farther in Alabama, as does the preceding.

Oxypolis filiformis (Walt.) Britton. Noticed first near Mississippi City, Harrison County, and last between Moss Point and the Escatawpa River, five or six miles from the coast.

Sabbatia macrophylla Hook. First near Lumberton, last between Hintonville and Glazier, Perry County.

Sabbatia decandra (Walt.) Harper. In a shallow pond near the middle of Jackson County, July 18, 1913.

Sabbatia gentianoides Ell. Flat damp pine-barrens near Fontainebleau and Moss Point, Jackson County.

Stokesia laevis (Hill) Greene. Noticed first in Forrest County, and last between Bexley and Merrill, George County. Commonest in the upper part of Harrison County; and not observed within 14 miles of the coast. I have also seen it a few times in Mobile County, Alabama, and once in the corresponding part of Georgia.*

Carphephorus Pseudo-Liatris Cass. In flat damp pine-barrens near the coast, Jackson County.

Many of the species above mentioned show a tendency to extend farther inland eastward than westward (and still more so in Alabama and Georgia), which appears to be correlated with the seasonal distribution of rainfall as much as anything else.

* See Bull. Torrey Club 32: 167. 1905.